SPANS

5

self-reported physical activity

There are many health benefits to be gained by regularly participating in physical activity during childhood and adolescence. Physical activity plays an important role in preventing unhealthy weight gain (Moore et al., 2003) and in maintaining weight loss among young people who are overweight or obese (Gutin et al., 2002). Weight-bearing physical activity such as walking, dancing and ball sports helps to maximise bone strength and bone mineral density, both important predictors of osteoporosis in later life (Bailey & Martin, 1994). Vigorous-intensity physical activity is also associated with improved blood pressure, cholesterol and insulin concentrations, all biomarkers related to coronary heart disease and type 2 diabetes among adults.

Furthermore, there is evidence that children and adolescents who are more active have more favourable psychological health (specifically, they are less likely to be depressed or anxious) (Calfas & Taylor, 1994) and that many forms of physical activity provide a way for young people to connect with their peers and develop important social skills. As such, it is important to understand the proportion of children and youth who are participating in adequate levels of physical activity, and whether differences exist between boys and girls, and across different sociodemographic groups.

There are many anecdotal reports that the children and adolescents of today are less active than previous generations of young people, but reliable evidence on this issue is not available. Such data would be extremely helpful as they would allow the characterisation of secular trends and the ways in which physical activity habits have changed among young people, if in fact they have.

full report

When the term 'physical activity' is used, it technically refers to any muscular movement that elevates energy expenditure above resting values. Therefore, it is much broader than organised or non-organised sports and includes activities such as walking, cycling and swimming; domestic chores; playground games; and even fidgeting. Considering the breadth of activities encompassed by physical activity, the measurement difficulties at a population level become evident, especially among children and adolescents, who do not have the same ability as adults to accurately recall or self-report their physical activity habits.

The *Adolescent Physical Activity Recall Questionnaire* (APARQ) (Booth, Okely, Chey & Bauman, 2002) was administered to students in Years 8 and 10, and students in Year 6 completed a modified version. Students were asked to think about a normal week in both summer and winter school terms and self-report the amount of time spent in organised and non-organised activities. As SPANS 2004 is the first representative survey of NSW school children that is comparable to the 1997 study, it allowed data to be gathered to examine trends in self-reported physical activity over the seven-year period 1997-2004. In addition, the physical activity participation questions used in the 1985 Australian Health and Fitness Survey (Pyke, 1987) were administered to separate Year 8 and 10 classes, allowing, to a limited extent, determination of trends in physical activity among NSW Year 8 and 10 students over the last 20 years.

Prevalence of physical activity during summer school terms by sex and Year group

Figure 5.1 and Table 5.1 show the prevalence of participating in at least 60 minutes of moderate-to-vigorous physical activity (MVPA) per day during summer school terms for boys and girls in Years 6, 8 and 10. Approximately 90% of boys and 80% of girls in Years 6 and 8 and around 80% of boys and 60% of girls in Year 10 participated in at least one hour of MVPA/day in summer. The differences between boys and girls were statistically significant in each Year group and increased with age. That is, a significantly greater proportion of boys were active compared with girls in Years 6, 8 and 10. Within genders, there was no difference in physical activity levels between Year 6 and Year 8. However, around 10% fewer boys and 20% fewer girls were active in Year 10 compared with Years 6 and 8.

Figure 5.1. Prevalence of one hour per day of MVPA during summer school terms among boys and girls in Years 6, 8, and 10 (%)

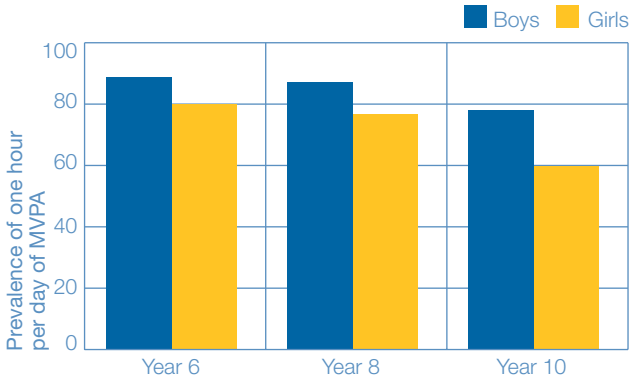


Table 5.1. Prevalence of one hour per day of MVPA during summer school terms among boys and girls in Years 6, 8 and 10 (%)

	Year 6	Year 8	Year 10
Boys	88.8	87.3	77.9
Girls	80.0*	76.8*	59.8*

* Indicates a statistically significant difference at P<.05 between boys and girls within the same Year group.

Prevalence of physical activity during summer school terms by rurality, socioeconomic status, cultural background and BMI category

Figure 5.2 and Table 5.2 show the prevalence of physical activity during summer school terms by rurality, socioeconomic status, cultural background and BMI category for boys and girls in Years 6, 8 and 10.

Rurality

In all Years, boys from rural schools were more active during summer than their urban school counterparts. These differences were small and non-significant in Years 6 and 8, but approached statistical significance among Year 10 boys. Among girls, there was no difference in the prevalence of activity between urban and rural girls in Year 6. However, rural girls displayed a clearly greater prevalence of adequate activity in Years 8 and 10, with this difference being highly statistically significant among Year 10 girls. It is notable that, whereas the prevalence of physical activity declined with age among urban girls, there were virtually no differences between Year 6, 8 and 10 rural girls.

Socioeconomic status

Among boys, there appeared to be a slight decrease in physical activity from low to high socioeconomic status tertiles, although this was very small and not statistically significant. Among girls, there was no consistent association between socioeconomic status and physical activity during summer, and the only statistically significant association was in Year 6 where a greater proportion of girls from high socioeconomic backgrounds were active compared with girls from low and medium tertiles.

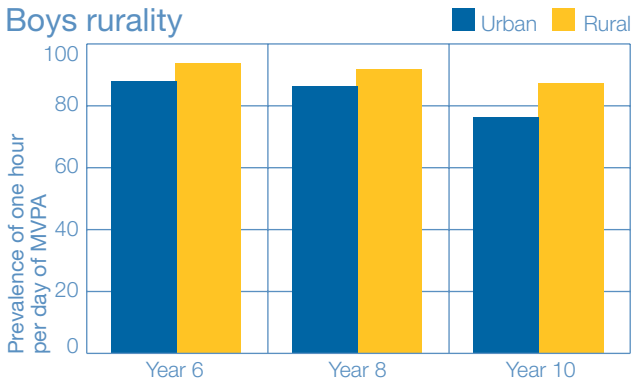
Cultural background

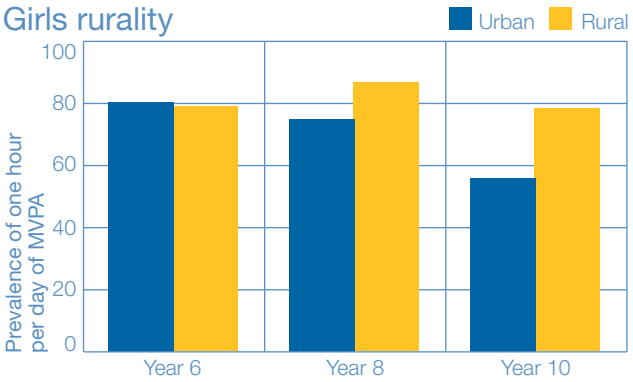
There was a consistent relationship between cultural background and physical activity during summer among boys. In each school Year, there were only small differences between boys from English-speaking, European, and Middle-Eastern backgrounds. However, boys from Asian backgrounds were clearly less active than boys from these other cultural groups, with the differences statistically significant in Year 8 and Year 10. Among girls, those from Middle-Eastern backgrounds displayed the lowest prevalence of physical activity in all Year groups. There was little difference between English-speaking, European, and Asian backgrounds among Year 6 girls. Among girls in Year 8, the prevalence of physical activity was clearly lower among girls from European and Asian cultural backgrounds than among those from English-speaking backgrounds. Among Year 10 girls, the prevalence of adequate activity was markedly lower among girls from Asian and Middle-Eastern cultural backgrounds compared with those girls from English-speaking and European backgrounds. The differences were statistically significant for Year 10 girls from Asian backgrounds. Statistics could not be calculated for the Middle-Eastern group because of low numbers.

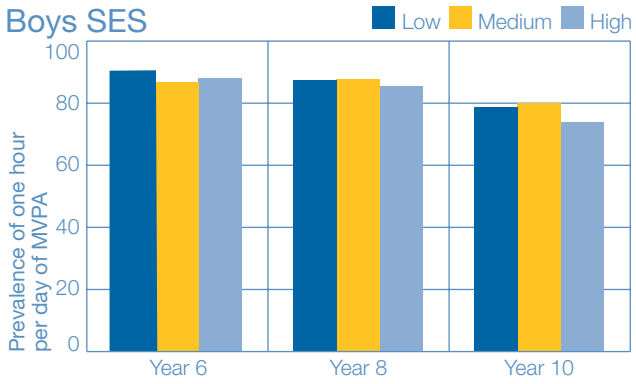
BMI category

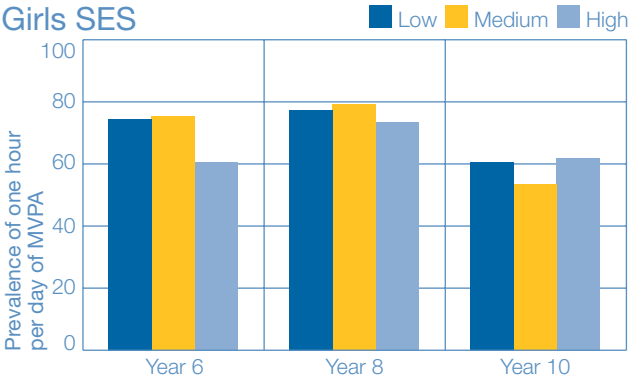
Among boys, the prevalence of adequate physical activity was generally higher in the healthy weight group than in the overweight or obese groups, although the differences were not large (none were statistically significant). Among Year 6 and Year 10 girls, the prevalence of adequate physical activity was higher in the healthy weight group than in the obese group and the differences among Year 8 girls were negligible. For all of the Year groups, none of the differences between BMI categories were statistically significant among girls.

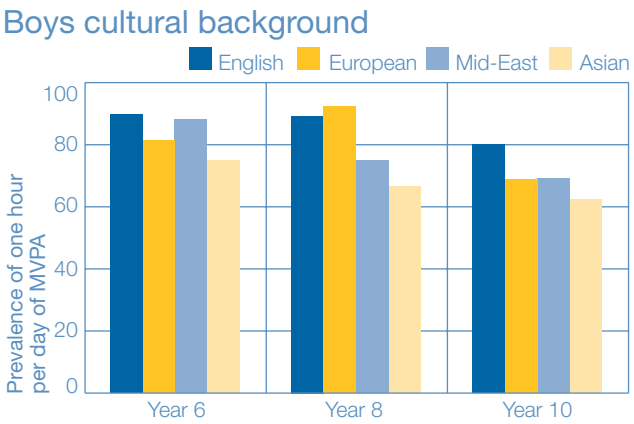
Figure 5.2. Prevalence of one hour per day of MVPA during summer school terms among boys and girls in Years 6, 8 and 10 by rurality, socioeconomic status (SES), cultural background and BMI category (%)

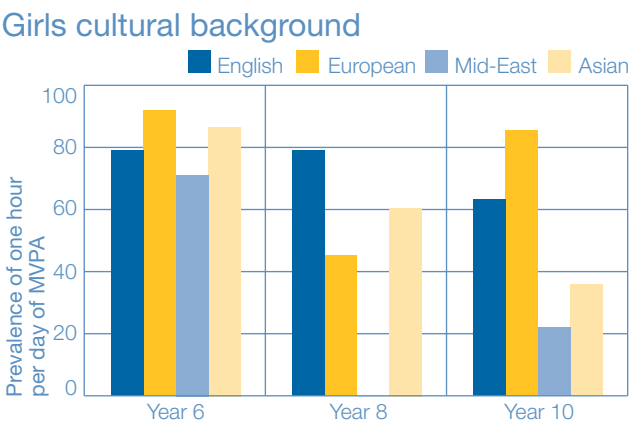


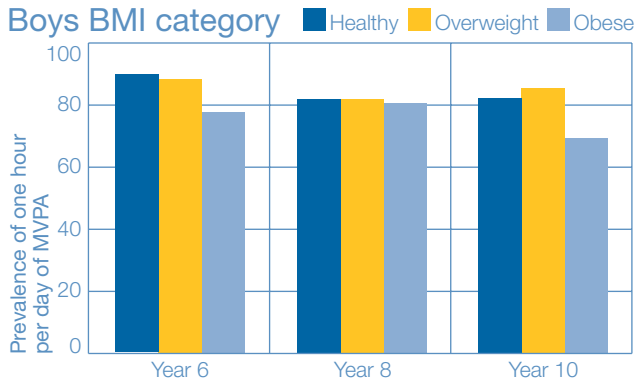












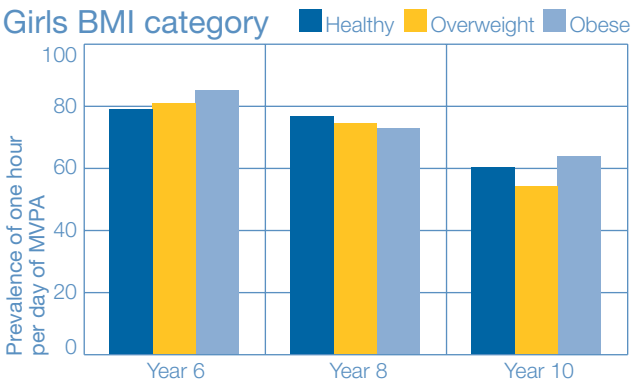


Table 5.2. Prevalence of one hour per day of MVPA during summer school terms among boys and girls in Years 6, 8 and 10 by rurality, socioeconomic status (SES), cultural background and BMI category (%)

	Boys			Girls		
	Year 6	Year 8	Year 10	Year 6	Year 8	Year 10
Rurality						
Urban	88.1	86.2	76.5	80.2	74.9	55.8
Rural	93.8	91.9	87.5	78.9	86.4	78.1*
SES						
Low	91.0	87.9	79.0	75.6*	76.3*	61.5
Medium	87.2	88.0	80.3	78.5	80.3	54.4
High	88.3	85.7	74.3	86.5	74.5	62.7
Cultural background						
English-speaking	89.8	89.3	80.0	79.4	79.1[n]	63.5
European	81.3	92.3	68.8	92.3	45.5	85.7
Middle-Eastern	88.2	75.0	69.2	71.4	–	22.2*
Asian	75.0	66.7*	62.5*	86.8	60.7	36.0*
BMI category						
Healthy weight	90.1	88.7	77.9	79.4	77.2	60.6
Overweight	87.0	82.3	81.0	81.5	75.0	54.5
Obese	82.5	85.7	69.4	85.7	73.3	64.3

* Indicates a statistically significant difference at P<.05. Comparisons are: between urban and rural; low and medium socioeconomic status compared with high socioeconomic status; European, Middle-Eastern and Asian cultural backgrounds compared with English-speaking cultural background; and overweight and obese compared with healthy weight. Comparisons are within each sex/Year group category.

n Indicates that statistical significance could not be calculated due to low numbers.

Prevalence of physical activity during winter school terms by sex and Year group

Figure 5.3 and Table 5.3 show the prevalence of participating in at least 60 minutes of moderate-to-vigorous physical activity per day during winter school terms among boys and girls in Years 6, 8 and 10. Around 80% of boys in all Years, 70% of girls in Years 6 and 8, and 55% of girls in Year 10 participated in at least one hour of moderate-to-vigorous physical activity per day during winter. In every Year, the differences between boys and girls were highly statistically significant. There was only a slight decline in the prevalence of physical activity across Years 6, 8 and 10 among boys. Among girls, the differences between school Years were slightly greater and increased with age. There was a 6% decrease from Year 6 to Year 8, and a further 10% decrease from Year 8 to Year 10. The prevalence of physical activity was only slightly lower during winter school terms than during summer school terms.

Figure 5.3. Prevalence of one hour per day of MVPA during winter school terms among boys and girls in Years 6, 8, and 10 (%)

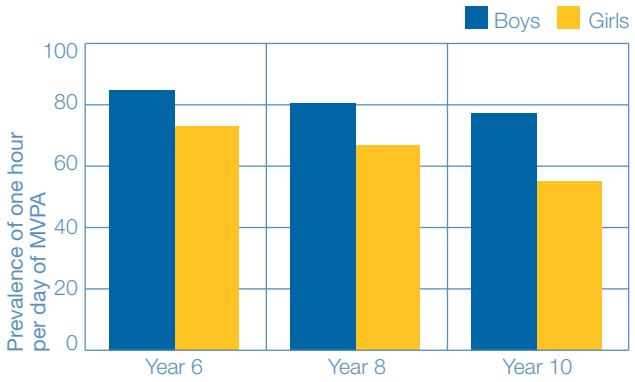


Table 5.3. Prevalence of one hour per day of MVPA during winter school terms among boys and girls in Years 6, 8, and 10 (%)

	Year 6	Year 8	Year 10
Boys	83.8	79.9	76.7
Girls	72.4*	66.2*	54.5*

* Indicates a statistically significant difference at P<.05 between boys and girls within the same Year group.

Prevalence of physical activity during winter school terms by rurality, socioeconomic status, cultural background and BMI category

Figure 5.4 and Table 5.4 show the prevalence of physical activity during winter school terms by rurality, socioeconomic status, cultural background and BMI category for boys and for girls in Years 6, 8 and 10.

Rurality

Boys and girls from rural schools were more active during winter than their urban school peers. With the exception of Year 6 boys, these differences were around 10% and approached, but did not reach, statistical significance in two Year groups (Year 8 boys and Year 10 girls).

Socioeconomic status

There was no relationship between socioeconomic status and prevalence of physical activity among boys. However, among girls, the association between socioeconomic status and physical activity was generally consistent, with those in the highest tertile more active than those in the medium and low tertiles. However, this association was only statistically significant among Year 6 girls.

Cultural background

The relationship between cultural background and physical activity was fairly consistent among boys. Boys from Middle-Eastern backgrounds had the lowest prevalence of physical activity in Year 6 and Year 10, with these differences statistically significant in both Years. There was little difference between boys from English-speaking and European backgrounds in all three Years. Boys from Asian backgrounds were quite similar in their activity levels to those from English and European backgrounds in Year 6, but had a significantly lower prevalence of activity in Year 8 and Year 10. Among girls, the relationship between cultural background and physical activity was mixed. In Year 6, girls from Middle-Eastern backgrounds were most active, with little difference between girls from English-speaking, European, and Asian backgrounds. In Year 8, girls from European and Asian backgrounds were much less active than those from English-speaking backgrounds. In Year 10, girls from Middle-Eastern and Asian backgrounds had clearly lower levels of physical activity than those from English-speaking and European cultural backgrounds, with these differences statistically significant.

BMI category

There were no clear associations between BMI category and physical activity among boys. However, among girls there was a general decline in the prevalence of physical activity from healthy weight to overweight to obese. All of the differences were small and not significant.

Figure 5.4. Prevalence of one hour per day of MVPA during winter school terms among boys and girls in Years 6, 8 and 10 by rurality, socioeconomic status (SES), cultural background and BMI category (%)

Table 5.4. Prevalence of one hour per day of MVPA during winter school terms among boys and girls in Years 6, 8 and 10 by rurality, socioeconomic status (SES), cultural background and BMI category (%)

	Boys			Girls		
	Year 6	Year 8	Year 10	Year 6	Year 8	Year 10
Rurality						
Urban	83.7	76.9	75.4	71.1	64.5	51.8
Rural	84.4	93.2	84.7	80.3	74.2	67.1
SES						
Low	81.3	84.9	74.3	70.1*	63.7	57.0
Medium	86.3	80.7	79.3	64.4*	64.1	49.2
High	83.9	73.6	76.0	83.9	70.2	56.7
Cultural background						
English-speaking	85.2	83.0	78.7	72.6	69.7[n]	58.4
European	81.3	92.3	75.0	61.5	36.4	85.7
Middle-Eastern	64.7*	75.0	53.9*	85.7	–	22.2*
Asian	75.0	47.2*	62.5*	68.4	35.7	28.0*
BMI category						
Healthy weight	83.7	78.4	74.6	73.8	65.4	56.1
Overweight	85.1	83.3	84.8*	67.9	70.8	47.3
Obese	80.0	85.7	75.0	68.6	53.3	50.0

* Indicates a statistically significant difference at P<.05. Comparisons are: between urban and rural; low and medium socioeconomic status compared with high socioeconomic status; European, Middle-Eastern and Asian cultural backgrounds compared with English-speaking cultural background; and overweight and obese compared with healthy weight. Comparisons are within each sex/Year group category.

n Indicates that statistical significance could not be calculated due to low numbers.

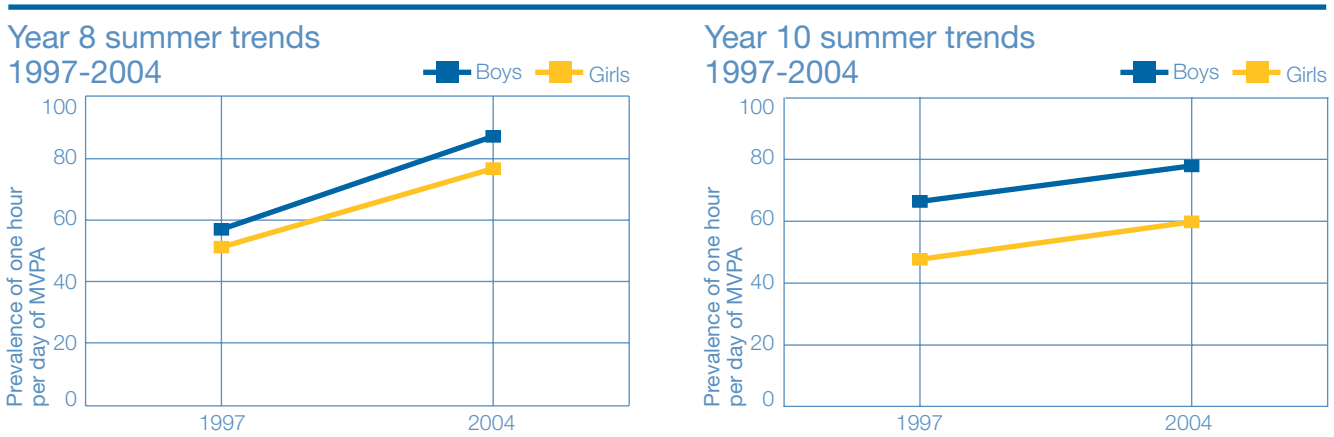
Trends in physical activity 1997-2004

Figures 5.5 and 5.6 and Table 5.5 show the prevalence of physical activity in 1997 and 2004 for boys and girls in Years 8 and 10 during summer and winter school terms. It is important to note that, in the *1997 NSW Schools Fitness and Physical Activity Survey* (Booth et al., 1997), the *Physical Activity Guidelines for Adolescents* (Sallis & Patrick, 1994) were used to determine the proportion of students in Years 8 and 10 who were adequately active. These guidelines recommended 30 minutes per day of moderate-to-vigorous physical activity. Since the more recent *Australia's Physical Activity Recommendations for Children and Young People* (Department of Health and Ageing, 2004) recommend one hour per day of moderate-to-vigorous physical activity, it was necessary to re-analyse the 1997 data. As such, the data presented here on the prevalence of recommended levels of physical activity among students in 1997 will be different from that previously presented in the 1997 report (Booth et al., 1997) and subsequent publications arising from those data (Booth, Okely, Chey, Bauman & Macaskill, 2002).

Trends in physical activity during summer school terms

Figure 5.5 and Table 5.5 show the prevalence of physical activity among Year 8 and Year 10 boys and girls during summer school terms in 1997 and 2004. The prevalence of physical activity was substantially higher in 2004. For boys, the increase in the prevalence was around 30% among Year 8 students and around 12% among Year 10 students. Among girls, the increases were approximately 25% among Year 8 and 12% among Year 10 students. That is, the percentage increases were greater among Year 8 students than Year 10 students. All of the differences between 1997 and 2004 were highly statistically significant.

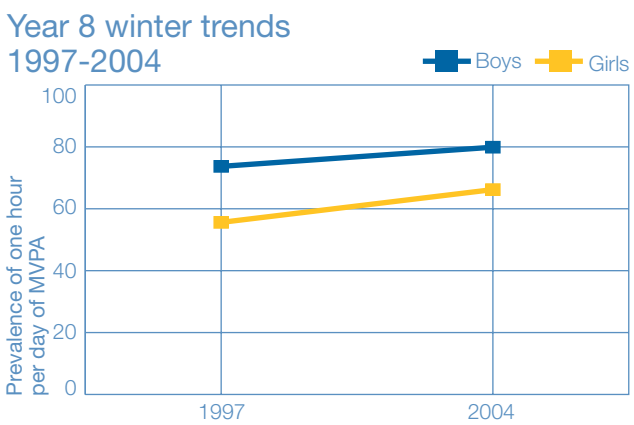
Figure 5.5. Prevalence of one hour per day of MVPA during summer school terms among boys and girls in Years 8 and 10 in 1997 and 2004 (%)



Trends in physical activity during winter school terms

Figure 5.6 and Table 5.5 show the prevalence of physical activity among Year 8 and Year 10 boys and girls during winter school terms in 1997 and 2004. The prevalence was higher in 2004 compared with 1997 among Year 8 boys and girls and Year 10 girls. For Year 8 boys and Year 10 girls, the differences were around 5% and not statistically significant. However, among Year 8 girls, the difference was 11% and was statistically significant. Contrary to the other groups, there was a small decrease (5%) in the prevalence of physical activity among Year 10 boys, which was not statistically significant.

Figure 5.6. Prevalence of one hour per day of MVPA during winter school terms among boys and girls in Years 8 and 10 in 1997 and 2004 (%)



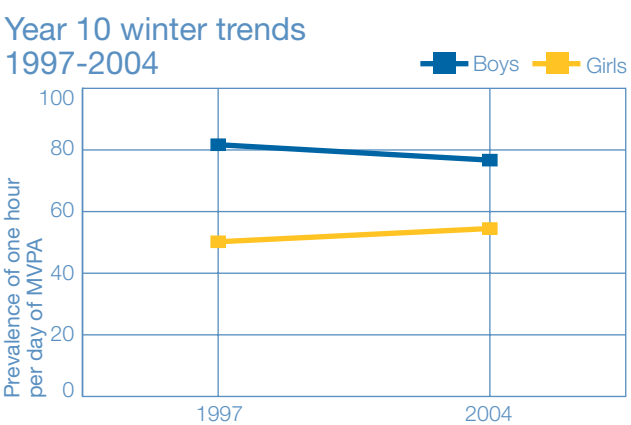


Table 5.5 Prevalence of one hour per day of MVPA during summer and winter school terms among boys and girls in Years 8 and 10 in 1997 and 2004 (%)

	Boys		Girls	
	Year 8	Year 10	Year 8	Year 10
Summer school terms				
1997	57.0	66.4	51.2	47.7
2004	87.3*	77.9*	76.8*	59.8*
Winter school terms				
1997	73.7	81.7	55.6	50.2
2004	79.9	76.7	66.2*	54.5

* Indicates that the difference in the prevalence of one hour per day of MVPA between 1997 and 2004 within sex and Year group was statistically significant at P<.05.

Trends in physical activity 1985-2004

A component of the NSW SPANS 2004 study collected physical activity participation data that could be compared with NSW data from the *Australian Health and Fitness Survey,* 1985 (Pyke, 1987).

This survey asked students to think only about the previous week, and to recall the number of times (frequency) and length of time (duration) spent in the following activities during that week: walking to school, cycling to school, physical education, school sport, and any other activities (up to four could be listed) (see Appendix D). From this information, the proportion of students in Years 8 and 10 who were adequately active during the previous week was calculated using the 60 minutes per day of MVPA guideline from the *Physical Activity Recommendations for Children and Young People* (Department of Health and Ageing, 2004). Additionally, the proportion of students in Years 8 and 10 who walked or cycled to school regularly (defined as at least four days per week) was calculated.

In all NSW SPANS analyses, the standard approach to comparing age groups has been to use school Year. However, the *Australian Health and Fitness Survey* did not collect information on the participants' school Year. Consequently, it was necessary to assign a school Year to each of the cases in the 1985 data set, based on the age of the participants, so that comparisons could be made between the 1985 and 2004 data. The procedure used to do this is described in detail in Appendix M.

Figure 5.7 and Table 5.6 show the prevalence of physical activity among boys and girls in Years 8 and 10 in 1985 and in 2004. Boys and girls in every Year group displayed quite large increases in the prevalence of physical activity from 1985 to 2004. For boys, these increases were just over 15% in Year 8 and around 20% in Year 10. Among girls, the increases were just under 25% in Year 8 and approximately 20% in Year 10. The increases were highly statistically significant in all cases.

Figure 5.7. Prevalence of one hour per day of MVPA among boys and girls in Years 8 and 10 in 1985 and 2004 (%)

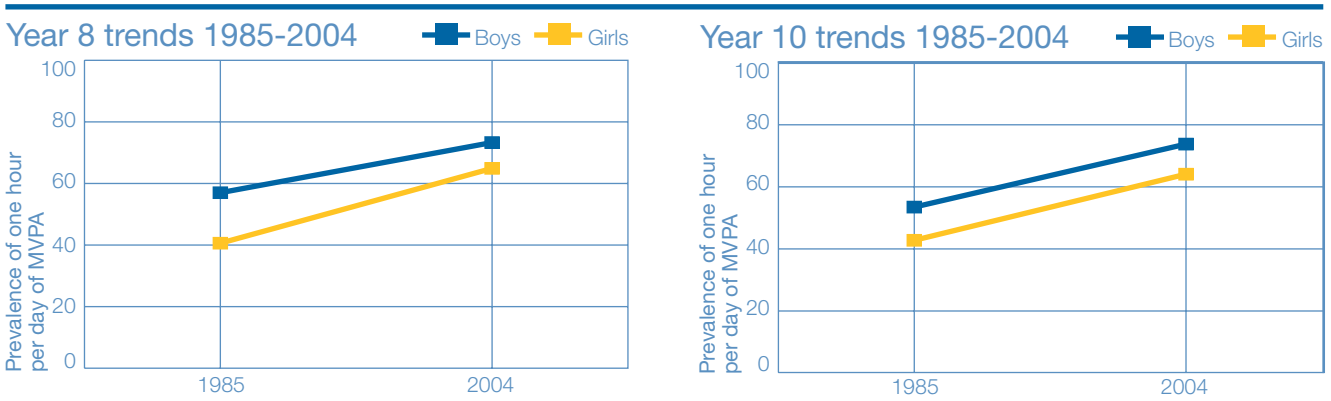


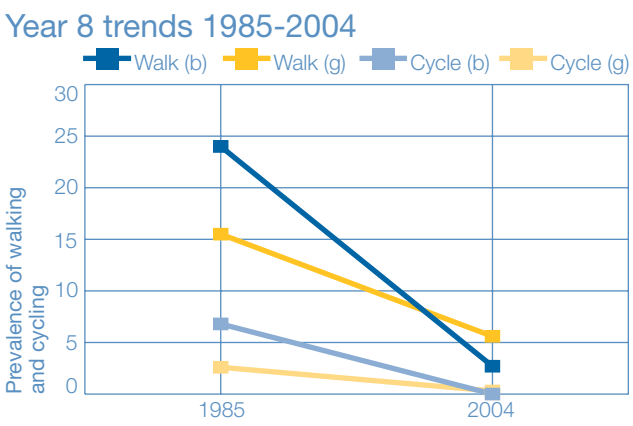
Table 5.6. Prevalence of one hour per day of MVPA among boys and girls in Years 8 and 10 in 1985 and 2004 (%)

	Boys		Girls	
	Year 8	Year 10	Year 8	Year 10
1985	57.0	53.3	40.6	42.6
2004	73.3*	73.6*	64.9*	63.9*

* Indicates that the difference in the prevalence of one hour per day of MVPA between 1985 and 2004 within sex and Year group was statistically significant at P<.05.

Figure 5.8 and Table 5.7 show the prevalence of regularly walking and cycling to school among boys and girls in Years 8 and 10 in 1985 and 2004. The prevalence of walking to school declined substantially among boys and girls in every Year group. Among boys, these decreases ranged from 10% in Year 8 to just over 15% in Year 10. Among girls, the decreases were around 20% in both Year 8 and Year 10. The decreases were statistically significant in all cases. The results were similar for cycling to school, with quite noticeable decreases between 1985 and 2004 among three of the four sex/Year groups. Although the prevalence of cycling was much lower than the prevalence of walking in 1985 (all under 10%), the decline over the 20-year period to 2004 was clear, ranging from 6.5% in Year 8 boys to just under 10% among Year 10 boys and from 0.2% in Year 10 girls to 2.6% among Year 8 girls. In 2004, virtually no high school students cycled regularly to school. The differences between 1985 and 2004 were statistically significant for all groups except Year 10 girls.

Figure 5.8. Prevalence of regularly walking and cycling to school (at least four days per week) among boys (b) and girls (g) in Years 8 and 10 in 1985 and 2004 (%)



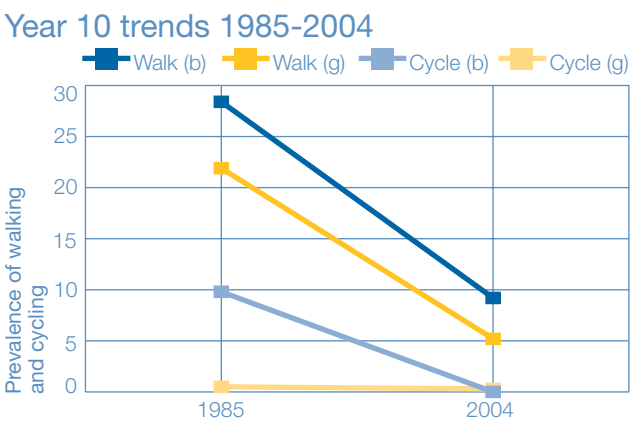


Table 5.7. Prevalence of regularly walking and cycling to school (at least four days per week) among boys and girls in Years 8 and 10 in 1985 and 2004 (%)

	Boys		Girls	
	Year 8	Year 10	Year 8	Year 10
Walking				
1985	15.5	24.0	21.9	28.4
2004	5.6*	2.7*	5.2*	9.2*
Cycling				
1985	6.8	2.6	9.8	0.5
2004	0.3*	0.0*	0.0*	0.3

* Indicates that the difference in regularly walking or cycling to school between 1985 and 2004 within sex and Year group was statistically significant at P<.05.

Discussion

SPANS was the first study to determine the proportion of young people who meet the recently released *Australian Physical Activity Recommendations for Children and Young People* (Department of Health and Ageing, 2004), based on a representative population sample. Three-quarters of boys and girls met the recommendations, although the prevalence estimates varied considerably between boys and girls and across Year groups.

Consistent with previous descriptive studies (Booth, Okely, Chey & Bauman, 2002; Pate et al., 2002; Riddoch et al., 2004; Trost et al., 2002), boys were found to be significantly more physically active than girls in both summer and winter and in all Year groups. These differences between boys and girls increased from around 10% in Year 6 and Year 8 to around 20% in Year 10, which is consistent with previous findings (Booth, Okely, Chey & Bauman, 2002) and reflects the relatively greater decline in physical activity participation among adolescent girls compared with adolescent boys.

Similar to previous studies, the prevalence of physical activity declined with age (Booth, Okely, Chey & Bauman, 2002; Pate et al., 2002; Riddoch et al., 2004; Trost et al., 2002). Although the decline from Year 6 to Year 8 was generally small and non-significant, it was greater from Year 8 to Year 10, averaging 10% among boys and 20% among girls.

Also consistent with previous studies, the prevalence of physical activity was found to be higher in summer than in winter (Booth, Okely, Chey, Bauman & Macaskill, 2002; Ross, Dotson, Gilbert & Katz, 1985). However, these differences were generally small (less than 10%) with the greatest differences occurring among girls in Year 6 and Year 8.

The finding that rural students were consistently more active than urban students is similar to previous studies in NSW (Booth, Okely, Chey, Bauman & Macaskill, 2002; Ross et al., 1985) and other states in Australia (Dollman, Norton & Tucker, 2002). These differences may be due to the role organised sports play in the culture of small towns and rural areas, often being the impetus for bringing together families and communities. Additionally, the perceived safety of rural environments may provide less of a barrier to physical activity than more densely populated urban areas (Gordon-Larsen, McMurray & Popkin, 2000).

The prevalence of physical activity did not vary with socioeconomic status for boys, which is consistent with previous Australian studies in these age groups (Booth, Okely, Chey, Bauman & Macaskill, 2002). However, the prevalence of physical activity was greater among girls from higher socioeconomic backgrounds and these differences were statistically significant among Year 6 girls. This finding is similar to a previous study (Booth, Okely, Che & Bauman, 2002) and may reflect these girls having better access to organised sports and non-organised physical activities and perhaps greater support and encouragement to participate in them from significant others (Yang, Telama & Laakso, 1996). It should be noted, however, that the measure of socioeconomic status used in SPANS is not particularly sensitive and may be clouding the association between activity and socioeconomic status.

The findings for cultural group comparisons were fairly consistent. There were negligible differences in Year 6; however, secondary school boys and girls from Middle-Eastern and Asian cultural backgrounds had a lower prevalence of physical activity than other cultural groups, with these differences statistically significant in around three-quarters of the comparisons. These differences are consistent with previous findings (Booth, Okely, Chey & Bauman, 2002; Fischbacher, Hunt & Alexander, 2004) and may be a result of lower levels of fitness and skills in adolescents from these cultural backgrounds (Booth et al., 1997; Booth et al., 1999), fewer opportunities (particularly among adolescent girls) to use active transport due to perceptions of safety, and the lower importance placed on physical activity by these cultural groups, especially for adolescent girls.

The finding of small and non-meaningful differences in activity prevalence between healthy weight, overweight and obese students is fairly consistent with the scientific literature. Although several prior studies have reported similar findings (Ekelund et al., 2004), others have found the opposite (that is, clear differences between overweight and healthy-weight students) (eg Trost, Kerr, Ward & Pate, 2001). The absence of a relationship in this study has several possible explanations. First, although the physical activity questionnaire used (APARQ) has been validated among these age groups (Booth, Okely, Chey & Bauman, 2002), self-reported physical activity is still prone to bias and overestimation among adolescents (Welk, Corbin & Dale, 2000). As such, those who are overweight may overestimate their physical activity (more so than healthy-weight adolescents), a hypothesis supported by studies that have found significant differences in physical activity between overweight and healthy-weight adolescents using more objective assessments of physical activity (Ekelund et al., 2002). Second, cross-sectional studies are unable to determine if an overweight adolescent is losing weight, if their weight is stable, or if they are gaining weight. As such, an overweight adolescent may be losing weight as a result of having increased their physical activity, but if they are still overweight at the time of assessment then they may have a high level of adiposity and may also have a high level of physical activity, potentially confounding the relationship between adiposity and physical activity.

Perhaps the most interesting findings for self-reported physical activity from this study are the secular changes in physical activity from 1985 to 2004 and from 1997 to 2004. For boys, the prevalence of physical activity increased in all but one case, with these increases highly statistically significant from 1985 to 2004 and from 1997 to 2004 for Year 8 and Year 10 boys in summer school terms. Among girls, the results were even more impressive. The prevalence of physical activity increased from 1985 to 2004 in both Year 8 and Year 10 and from 1997 to 2004 in all groups and across both seasons, with these increases statistically significant in five out of six comparisons.

The findings were consistent in both comparisons (1985 to 2004 and 1997 to 2004) for both boys and girls across both Year groups and seasons and are contrary to the perception that physical activity participation has declined among adolescents over recent years. The only other published data to have examined secular trends in physical activity among Australian youth recently reported a similar finding. The Australian Bureau of Statistics (2003) found that children's participation rates in organised sports had increased from 2000 to 2003. Although the SPANS data included both organised and non-organised activities, it should be remembered that organised activities are the easiest for adolescents to recall and that the results can probably be largely explained by an increase in organised sports participation by adolescents.

The finding that physical activity has increased over the period 1985 to 2004 has particular relevance when considered against an increased prevalence of overweight and obesity among adolescents over the same period. The prevalence of overweight and obesity combined doubled over the period 1985 to 1997 (Booth et al., 2003) and data from this report has shown that the prevalence of overweight and obesity has increased from 1997 to 2004 by around

five percentage points. On one hand, there has been a significant increase in the prevalence of overweight and obesity from 1985 to 2004 and on the other hand a significant *increase* in the prevalence of physical activity over the same period.

There are at least two possible explanations for these apparently contradictory findings. First, they may be partly explained by the types of physical activity measured by self-report questionnaires. Although good self-report instruments reliably assess moderate-to-vigorous-intensity organised and non-organised physical activity, they do not assess incidental activities (walking, chores, moving around) very well (Kohl, Fulton & Caspersen, 2000). It may be possible that, although participation in moderate-to-vigorous-intensity activity has increased, incidental activity has decreased substantially among young people over the same period, resulting in an overall decline in energy expenditure due to physical activity. However, because walking and incidental activities are usually of a very low intensity, they do not account for a large proportion of total energy expenditure. Consequently, it is very unlikely that reductions in energy expenditure due to reduced participation in incidental activity and walking would match the increased energy expenditure due to participation in moderate-to-vigorous-intensity physical activity.

The second, and more plausible, explanation is that the kinds and amounts of foods eaten by young people and the eating behaviours of young people have resulted in substantially increased energy intake over the period 1985 to 2004. Energy consumption may well have increased by a greater amount than has energy expenditure due to physical activity, resulting in positive energy balance (greater intake than expenditure) and increasing adiposity.

An interesting finding among the physical activity data from 1985 to 2004 was the change in active commuting to school. These findings were consistent and showed a large and statistically significant decrease in the prevalence of regularly walking or cycling to school among boys and girls. Overseas studies have shown a similar decline in active commuting to school over the same period (Roberts, 1996). There are several potential explanations for these findings. First, fewer secondary school students may attend their local school in 2004, compared with 1985, which means that they live too far away to walk or cycle. Second, a possible increase in road traffic over this period may have increased the perceived danger of walking, and especially cycling, to school. Third, parental concerns, not only about pedestrian and road safety, but safety of their children in general (Dellinger & Staunton, 2002) may have increased. A further barrier to cycling to school may be the lack of facilities in most secondary schools for secure storage of bicycles.

The finding of an increase in the prevalence of physical activity from 1985 to 2004 and from 1997 to 2004 was encouraging and there are several reasons to be confident of the robustness of these results, especially from 1997 to 2004. First, both the 1997 and 2004 studies were conducted in the same months of the year (February to April) and used the same instrument, administered using identical procedures. Second, the results are consistent with the findings from this survey for secular changes in cardiorespiratory fitness and fundamental movement skills over the same time period (1997 to 2004). Cardiorespiratory fitness and fundamental movement skills are both objective measures and not prone to self-report bias. Both are related to physical activity among adolescents (Okely, Booth & Patterson, 2001a, 2001b) so increases in these attributes should also result in increases in self-reported physical activity over the same period of time.

References

Australian Bureau of Statistics 2003, Children's participation in cultural and leisure activities, *Australia: Catalogue No. 4901.0,* Canberra: Australian Bureau of Statistics.

Bailey DB, Martin AD 1994, Physical activity and skeletal health in adolescents, *Pediatric Exercise Science*, 6, 330-347.

Booth M, Macaskill P, McLellan L, Phongsavan P, Okely AD, Patterson J 1997, *NSW Schools Fitness and Physical Activity Survey,* Sydney: NSW Department of School Education.

Booth ML, Chey T, Wake M, Norton K, Hesketh K, Dollman J 2003, Change in prevalence of overweight and obesity among young Australians, 1969-1997, *American Journal of Clinical Nutrition*, 77, 29-36.

Booth ML, Okely AD, Chey T, Bauman A 2002, The reliability and validity of the Adolescent Physical Activity Recall Questionnaire, *Medicine & Science in Sports & Exercise*, 34, 1986-1995.

Booth ML, Okely AD, Chey T, Bauman A, Macaskill P 2002, Epidemiology of physical activity participation among NSW school students, *Australian and New Zealand Journal of Public Health,* 24, 371-374.

Booth ML, Okely AD, McLellan L, Phongsavan P, Macaskill P, Patterson J 1999, Mastery of fundamental motor skills among New South Wales school students: Prevalence and sociodemographic distribution, *Journal of Science and Medicine in Sport,* 2, 93-105.

Calfas, KJ, Taylor WC 1994, Effects of physical activity on psychological variables in adolescents, *Pediatric Exercise Science,* 6, 406-423.

Dellinger AM, Staunton CE 2002, Barriers to children walking and biking to school – United States, 1999, *Journal of the American Medical Association,* 288, 1343-1344.

Department of Health and Ageing 2004, *Australia's Physical Activity Recommendations for Children and Young People,* Canberra, Commonwealth of Australia.

Dollman J, Norton K, Tucker G 2002, Anthropometry, fitness, and physical activity of urban and rural South Australian children, *Pediatric Exercise Science,* 14, 297-312.

Ekelund U, Aman J, Yngve A, Renman C, Westerterp K, Sjostrom M 2002, Physical activity but not energy expenditure is reduced in obese adolescents: a case study, *American Journal of Clinical Nutrition,* 76, 935-941.

Ekelund U, Sardinha LB, Anderssen SA, Harro M, Franks PW, Brage S, 2004, Associations between objectively assessed physical activity and indicators of body fatness in 9- to 10-y-old European children: a population-based study from 4 distinct regions in Europe (the European Youth Heart Study), *American Journal of Clinical Nutrition,* 80, 584-590.

Fischbacher CM, Hunt S, Alexander L. 2004, How physically active are South Asians in the United Kingdom? A literature review, *Journal of Public Health,* 26, 250-259.

Gordon-Larsen P, McMurray RG, Popkin BM 2000, Determinants of adolescent physical activity and inactivity patterns, *Pediatrics,* 105, 63-70.

Gutin B, Barbeau P, Owens S, Lemmon CR, Bauman M, Allison J, 2002, Effects of exercise intensity on cardiovascular fitness, total body composition, and visceral adiposity of obese adolescents, *American Journal of Clinical Nutrition,* 75, 818-826.

Kohl HW, Fulton JE, Caspersen CJ 2000, Assessment of physical activity among children and adolescents: a review and synthesis, *Preventive Medicine,* 31, S54-S76.

Moore LL, Gao D, Bradlee ML, Cupples, LA, Sundarajan-Ramamurti A, Proctor MH, 2003, Does early physical activity predict body fat change throughout childhood? *Preventive Medicine,* 37, 10-17.

Okely AD, Booth ML, Patterson, JW 2001a, Relationship of cardiorespiratory endurance to fundamental movement skill proficiency among adolescents, *Pediatric Exercise Science,* 13, 380-391.

Okely AD, Booth ML, Patterson, JW 2001b, Relationship of physical activity to fundamental movement skills among adolescents, *Medicine and Science in Sports and Exercise,* 33, 1899-1904.

Pate, RR, Freedson PS, Sallis JF, Taylor, WC, Sirard JR, Trost SG, 2002, Compliance with physical activity guidelines: Prevalence in a population of children and youth, *Annals of Epidemiology,* 12, 303-308.

Pyke JE 1987, *The Australian Health and Fitness Survey 1985: The fitness, health and physical performance of Australian school students aged 7-15 years,* Adelaide: The Australian Council for Health, Physical Education and Recreation (ACHPER).

Riddoch CJ, Andersen LB, Wedderkopp N, Harro M, Klasson-Heggebo L, Sardinha LB, 2004, Physical activity levels and patterns of 9- and 15-year-old European children, *Medicine and Science in Sports and Exercise,* 36, 86-92.

Ross JG, Dotson CO, Gilbert GG, Katz SJ 1985, The National Children and Youth Fitness Study: After physical education...physical activity outside of school physical education programs, *Journal of Physical Education, Recreation, and Dance*, 56, 77-81.

Sallis JF, Patrick K 1994, Physical activity guidelines for adolescents: Consensus statement, *Pediatric Exercise Science,* 6, 302-314.

Trost SG, Kerr LM, Ward DS, Pate RR 2001, Physical activity and determinants of physical activity in obese and non-obese children, *International Journal of Obesity,* 25, 822-829.

Trost SG, Pate RR, Sallis JF, Freedson PR, Taylor WC, Dowda M, 2002, Age and gender differences in objectively measured physical activity in youth, *Medicine and Science in Sports and Exercise,* 34, 350-355.

Welk, GJ, Corbin CB, Dale D 2000, Measurement issues in the assessment of physical activity in children, *Research Quarterly for Exercise and Sport,* 71, 59-73.

Yang X, Telama R, Laakso L 1996, Parents' physical activity, socioeconomic status and education as predictors of physical activity and sport among children and youths: A 12-year follow-up study, *International Review for the Sociology of Sport,* 31, 273-294.